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The Relationship between Parental Involvement and Mathematics Achievement

for Youth with Visual Impairments

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Abstract

The effect of parental involvement on achievement has received a significant amount of research attention in the general student population but surprisingly very little research has been conducted in this area for students with disabilities. This study investigated the association between parental involvement (both at home and at school) and mathematics achievement for youth with visual impairments. The sample used for the study was taken from the nationally representative Special Education Elementary Longitudinal Study. Multilevel modeling for longitudinal data was used to investigate the research questions. Both types of parental involvement were associated with mathematics achievement, but each in a different direction and each differed based on the presence of a cognitive disability.

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Blindness and low vision stakeholders (e.g., parents, consumers, educators) have long been concerned about the apparent mathematics achievement gap between students who are visually impaired (that is those who are blind or have low vision) and their sighted peers. Further, specialized teachers of visually impaired students have continued to express concerns about their ability to provide students quality instruction in the braille mathematics code (e.g., Demario, Lang, & Lian, 1998; Rosenblum & Amato, 2004). In response, a national center was established in 2004 to serve as a clearinghouse on information, products, and programs to improve access for VI youth to math, science, technology, and engineering instructional materials and careers (National Center for Blind Youth in Science, n.d.). Examples of other initiatives have included adapting mathematics tutoring and enrichment programs via text to speech and/or braille (e.g., Beal, Walles, & Woolf, 2007; National Center for Blind Youth in Science, n.d.) and the establishment of a national electronic file repository to make files available for production of instructional materials in specialized formats such as braille (National Instructional Materials Access Center, 2009). Software tutorials have also been developed to assist both teachers and students in learning the Nemeth braille code for mathematics (Kapperman & Sticken, 2003)

Although there has been much anecdotal information indicating that students with visual impairments (VI) lag behind their sighted peers in mathematics achievement, only recently have empirical studies confirmed this. Analyses of the Special Education Elementary Longitudinal Study (SEELS) revealed that students with a primary disability of VI (ages 7 through 12 when entering the longitudinal study) were approximately one-half year behind grade level in

mathematics (Blackorby & Cameto, 2004). Analyses of the National Longitudinal Transition Study-2 revealed that older students with a primary disability of VI (ages 13 through 16 when entering the study) were even further behind—almost 3 years below grade level (Blackorby, Chorost, Garza, & Guzman, 2003).

Although data on statewide accountability tests are limited, available information does show that students with visual impairments score lower than non-disabled students. For example, Winford (2003) found that students with a VI but no secondary disabilities performed below their sighted peers on a statewide assessment of mathematics. The North Carolina State Board of Education (2009) is one of the few states that report student assessment data disaggregated by federally defined disability categories. In the 2007-2008 school year, 56% of students with a primary disability of VI/blindness in grades 3 through 8 scored at or above grade level in mathematics compared with 74% of students without disabilities.

It is important to note that these findings only describe students with a *primary* disability of visual impairment. Students with a VI who were designated as having another primary disability were not included in any of the analyses. The population of excluded students (i.e., students with another primary disability who also have a vision loss) is thought to be large. For example, Kirchner and Diamant (1999) estimated that more than 50% of the population of students with VI, aged birth to 21 years, had at least one other disability. Exclusion of these students in studies can lead to misinterpretations of the educational needs of students with a VI and has long been a concern among blindness and low vision educators (e.g., Mason & Davidson, 2000).

Although research is limited, there is a documented disparity in mathematics achievement for youth with VI. One factor that is thought to have a positive impact on school achievement,

including mathematics achievement, for the general population is parental involvement. In fact, it is considered to be so important to educational achievement that one of the six targeted areas for reform of the No Child Left Behind Act of 2001 is increasing parental involvement.

Educational reforms in several states also include efforts to increase parental involvement (Pomerantz, Moorman, & Litwack, 2007).

Parental involvement has received a considerable amount of research attention, which for the most part has supported its importance. So much research has been conducted that a large number of review articles, including meta-analyses and a systematic review, have been published (e.g., Fan & Chen, 2001; Hill & Tyson, 2009; Nye, Turner, & Schwartz, 2006; Patall, Cooper, & Robinson, 2008; Pomerantz et al., 2007). However, despite the considerable attention parental involvement has received among the general population of students, a surprisingly limited amount of research has been conducted with students with disabilities, or students in special education. In fact, no published research on the effects of parental involvement on achievement of students with visual impairments could be located.

Parental involvement can be defined in several ways. For the purposes of this article, parental involvement will be differentiated by where it occurs: either in school or outside of school, which will be referred to as “at home.” Parental involvement at school involves activities that require contact with the school and can include such things as meeting with a teacher or administrator, attending general school meetings, attending school events, and volunteering at the school. Parental involvement at home can include such things as assistance with homework, talking to the child about school experiences, reading the newspaper or other material to the child, and taking the child to the library or a museum.

#### *Parental Involvement at Home*

A recent systematic review of parental involvement at home concluded that parental involvement has a positive and significant effect on children's overall academic achievement (Nye et al., 2006). This review only included experimental studies that used a randomized controlled design. In other words, the studies involved interventions meant to increase parental involvement, with one group serving as a control to the experimental group. The 18 studies, which spanned a period of 40 years, resulted in an overall average effect size of  $d=0.45$ , which was considered important in practical terms. Five of the 18 studies investigated mathematics achievement specifically; the average effect size in this area was  $d=0.54$ . Although this effect was large, it was not very precise because one of those studies reported an extremely large effect size ( $d=1.50$ ; Heller & Fantuzzo, 1993).

Another common methodology of research has been to investigate the effect of naturally occurring parental involvement by measuring the amount of involvement, according to either the parent, the child, or a teacher, and determining whether an association exists between this measure and student achievement. This research has involved both cross-sectional and longitudinal studies. Findings from this type of research are less clear as to the benefits of parental involvement (Pomerantz et al., 2007). Some of the research has supported the positive effects of parental involvement at home on student achievement, particularly for activities that are not directly related to school, but rather to general academic enrichment. Findings on the effects of parental involvement in activities that are directly related to school have been mixed, with some results even indicating a negative relationship between involvement and achievement (Pomerantz et al., 2007).

Patall and colleagues (2008) conducted a meta-analysis of the effects of parental involvement in homework, a common type of parental involvement at home. They reviewed

research that involved both experimental designs and naturally occurring involvement. The overall effect of parental involvement in homework across all types of designs was small and usually not significant. However, results did differ based on the child's age (more effective for younger students) and subject matter (e.g., experimental studies exhibited a positive relationship for mathematics but correlational studies exhibited a negative relationship for mathematics). Another recent meta-analysis focusing on middle-school students supported these findings: parental involvement was positively associated with achievement, with the exception of parental help with homework (Hill & Tyson, 2009).

#### *Parental Involvement at School*

Findings on the positive benefits of involvement at school have been more consistent. A high percent of parents report participation in school activities, such as attending a general school meeting (89%), attending a parent-teacher conference (78%), attending a school event (74%), and volunteering at school (46%) (U.S. Department of Education, 2008). These percentages are highest when students are in elementary school, and they decrease as students advance to higher grades. Both cross-sectional and longitudinal research has documented an association between naturally occurring parental involvement in school and higher achievement (Fan & Chen, 2001; Hill & Tyson, 2009; Pomerantz et al., 2007). This involvement in early grades has been shown to predict later achievement – even achievement in high school (e.g., Barnard, 2004; Izzo, Weissberg, Kaspro, & Fendrich, 1999). However, intervention research meant to promote parental involvement in school activities has not provided as much support for its benefit to achievement as the correlational research has (Pomerantz et al., 2007).

#### *The Mechanisms by Which Parental Involvement Influences Achievement*



Explanations for why and how parental involvement influences achievement have been proposed by several authors. Hill and Taylor (2004) suggested two mechanisms for this relationship: *increasing social capital* and *social control*. Parental involvement is thought to increase parents' skills and information (social capital), making them better prepared to assist their children with school-related activities. The relationships parents establish with school personnel allow them to increase their knowledge of the school's expectations and may provide the opportunity for them to learn how to help at home more effectively. Social control occurs when parents and schools work together to provide the same message to children about appropriate behavior. If this message is the same across both settings it is expected to reduce problem behaviors.

Pomerantz et al. (2007) described two sets of models by which parental involvement can effect achievement: *skill development models* and *motivational development models*. The idea behind skills development models is that parents' involvement in school activities provides children with skill-related resources such as cognitive skills and metacognitive skills. Motivational development models suggest that parental involvement benefits children's achievement because it provides them with a number of motivational resources that encourage their engagement in school. In general, the idea is that parental involvement can have a direct effect on achievement by improving children's skills (such as by helping with homework) or an indirect effect by increasing motivation for school or improving student behavior, which are associated with achievement.

#### *Differential Effects of Parental Involvement by Grade Level*

Parental involvement tends to decrease as children get older, and the majority of parental involvement research and interventions have focused on elementary age children. However, the

effects of parental involvement at different grade levels has been the subject of more recent research. Some of this research involving middle school and high school students has documented little or no relationship between parental involvement and achievement for these students (e.g., Fan, 2001; Bronstein, Ginsberg, & Herrera, 2005) while other studies have found a positive relationship between parental involvement and adolescents' achievement (e.g., Catsambis, 2001; Grolnick, Kurowski, Dunlap, & Hevey, 2000; Hill et al., 2004). A recent meta-analysis of the relationship between parental involvement and academic outcomes for middle school students documented a positive relationship for involvement at school and academic socialization, but not for involvement at home (Hill & Tyson, 2009). Similarly, Patall and colleagues (2008), in their meta-analysis of the relationship between parental involvement with homework and achievement, found that involvement is effective for elementary age students but not for middle school students. It has also been suggested that the mechanism by which parental involvement exerts a positive effect on achievement is harder to realize in middle school than elementary school (Hill & Tyson, 2009).

#### *Research Involving Students with Disabilities*

Research concerning parental involvement of students with disabilities is surprisingly limited, particularly given the fact that parental involvement is obviously considered important for this population: involvement is mandated by the Individuals with Disabilities Education Act (IDEA) of 2004 for planning the child's Individual Education Program. Much of the research that has been conducted in this area has been descriptive in nature, measuring levels of parental involvement for various subgroups of students with disabilities, or has involved a comparison of the levels of parental involvement of students in the general population and special education students. A few research studies have documented similar levels of involvement for parents of

students with disabilities and parents of students without disabilities (Gerstein, 2006; McKinney & Hocutt, 1982; Yanok & Derubertis, 1989), but two studies found general education students to have higher levels of parental involvement in certain areas (Deslandes, Royer, Potvin, & Leclerc, 1999; Rogers, Wiener, Marton, & Tannock, 2009).

Although no published research relating parental involvement to achievement for students with disabilities could be found, two unpublished dissertations that addressed this topic were located. One of these studies investigated the relationship between parental involvement and achievement for students with learning disabilities and serious emotional disturbances (Woika, 1993). Parental involvement was measured by school initiated home-school contact, parent initiated home-school contact, and other involvement such as Parent Teacher Organization and volunteer activities. Results indicated that the three parent involvement factors combined were a significant predictor of achievement, but that both types of home-school contact tended to be associated with lower achievement while other involvement tended to be associated with higher achievement. A more recent study also evaluated the benefits of parental involvement for a group of students with learning disabilities, including its relationship with grades (Gerstein, 2006). Results indicated that higher grades were correlated with both parents' involvement, particularly school-related involvement for mothers and fathers' involvement in personal activities.

### *The Current Study*

Given the documented disparity in mathematics achievement for youth with visual impairments, it is important to consider alterable factors that could result in improved mathematics achievement for this population. One such factor is parental involvement, yet the relationship between parental involvement and achievement for youth with visual impairments

has not been studied. It is possible that the relationship for this population may differ from the relationship exhibited in the general population. Parental involvement may not be able to impact the difficulties visually impaired students face with mathematics. For example, if difficulty seeing the board and following along during class causes decreased performance, parental involvement at home may not be able to compensate for these problems. On the other hand, parental involvement at school may assist the student in receiving the assistive technology and supports he or she needs to succeed (Kelly, 2009), and might exhibit a stronger relationship with achievement. Achievement levels tend to be lower for students with cognitive impairments, and parental involvement may not have the same effect for them. Therefore, we also thought it important to consider whether this relationship differs based on the presence of a cognitive impairment or grade level (as documented in other research).

### *Research Questions*

The following research questions were investigated in the current study:

1. Is parental involvement at home associated with mathematics achievement for youth with visual impairments in elementary and middle school?
2. Is parental involvement at school associated with mathematics achievement for youth with visual impairments in elementary and middle school?
3. Does the effect of parental involvement (at home or at school) on achievement differ based on (a) grade level or (b) the presence of a cognitive disability for youth with visual impairments?

### Method

#### *Data Source*

The database used to investigate our research hypotheses was the Special Education Elementary Longitudinal Study (SEELS). SEELS, conducted by SRI International and funded by the Office of Special Education Programs, is a nationally-representative database of school-age students conducted between the years 2000 and 2005. A two-stage process was used to identify the sample; first, a stratified sample (based on geographic region, district size, and district/community wealth) of local education agencies (LEA) and state-supported schools for students with disabilities was identified. Next, students were randomly selected for participation from rosters of special education students in the schools in these LEAs and the special schools.

SEELS is a comprehensive study, documenting the achievement, personal characteristics, and educational experiences of a sample of elementary special education students as they move through the school system, up to high school. Data collection from several sources occurred up to three times for each student. Data were collected about the students' family characteristics and non-school activities, classroom experiences, instructional goals, accommodations, and school programs, policies and practices. Students were assessed directly on achievement, self-concept, and attitudes toward school.

### *Sample*

The population of interest to this study was students with visual impairments. These students were identified by either having a primary disability of visual impairment (one of the 13 special education disability categories), or by being identified by their parent or teacher as having a visual impairment, despite this not being their primary disability. (A decision was made to exclude those students identified as deaf-blind, as these students have unique challenges and needs, and should ideally be studied separately.) Although these two groups were combined for the analyses, as our population of interest was all students with visual impairments, a variable

was included in the analyses to distinguish which students had visual impairment as their primary disability and which had visual impairment as a secondary disability. All students identified as having a visual impairment who had scores available on the Calculations subtest of the Woodcock-Johnson III and parental involvement data (for at least one of the two variables) were included in the sample (N=425). Several of these students had a cognitive disability in addition to their visual impairment (n=62).

### *Variables*

#### *Dependent Variable*

The Calculations subtest of the Woodcock-Johnson III Tests of Achievement (WJ-III ACH) measures mathematics computational skills, ranging in difficulty from simple to advanced. The easiest problems require the student to perform single-digit addition, while the most difficult involve calculus (Blackorby, Chorost, Garza, & Guzman, 2004). This is a written test. The W scores available in the WJ III ACH are Rasch-scaled scores that have the quality of equal interval units. They are centered to a value of 500, which has been set to approximate the average performance of students beginning the 5<sup>th</sup> grade (Woodcock, McGrew, & Mather, 2001). Because of its fixed setting to 5<sup>th</sup> grade student performance, the W score is ideal for use in longitudinal analyses.

The WJ-III ACH is a well-developed and thoroughly evaluated instrument. Reviewers in the 15<sup>th</sup> Mental Measurements Yearbook gave it the highest praise, both considering it the best available instrument to measure achievement (Cizek, 2003; Sandoval, 2003). It was developed based on the Cattell-Horn-Carroll theory of cognitive abilities and educational core curricular areas and domains specified in federal legislation. The WJ-III ACH exhibits good to excellent reliability; the reported split-half reliability coefficients for the two tests are .86 and .93,

respectively. It is based on several sources of empirically-sound validity evidence. Construct validity has been supported with confirmatory factor-analytic models, while concurrent validity is supported by the test's correlations with other established achievement tests, such as the Wechsler Individual Achievement Test and the Kaufman Test of Educational Achievement (Schrank et al., 2001).

### *Independent Variables*

Parental involvement at home was a scale available in the SEELS database that consisted of three items measuring the frequency of parental interaction with the child in the following areas: (a) spoke with about experiences in school, (b) helped with homework, and (c) read to. Responses were on a scale from “not at all” assigned a value of 1 to “every day” assigned a value of 4. Total scores ranged from 3 to 12, with higher scores indicating a greater amount of involvement at home. Therefore, a score of 3 indicates no parental involvement in these areas, and a score of 12 indicates every day involvement in all three areas. Prior to entering this variable in the model, it was centered around its approximate mean of 9. This variable was modeled as time-variant, meaning that its value could change at each wave. A total of 407 students had parental involvement at home and mathematics achievement data available. The total number of observations used in the analyses was 763, with the following number of observations available per person: 152 had one observation, 154 had two observations, and 101 had all three observations.

Parental involvement at school was a scale available in the SEELS database that consisted of three items measuring the frequency of parent attendance at the school for the following reasons: (a) a general school meeting, (b) a school/class event, (c) volunteered at school. Responses were on a 5-point scale from “none” to “more than 6 times” with scores

ranging from 0 to 4. Total scores ranged from 0 to 12, with higher scores indicating a greater amount of involvement at school. A score of 0 would indicate that the parents never attended their child's school for any of these reasons, and a score of 12 would indicate that the parents attended the school more than six times for *each* of these reasons. Prior to entering this variable in the model, it was centered around its approximate mean of 4. This variable was modeled as time-variant, meaning that its value could change at each wave. Parental involvement at school and mathematics achievement data was available for 425 students. The total number of observations used in the analyses was 819, with the following number of observations available per person: 143 had one observation, 170 had two observations, and 112 had all three observations.

#### *Control Variables*

Several variables that are known to be related to mathematics achievement, and possibly to parental involvement, were included in the models to control for their effects. The control variables included in the models were primarily demographic or disability-related: family socioeconomic status (SES), gender, initial grade level, VI as primary disability, and presence of a cognitive disability. In addition to these control variables, a variable to indicate elementary school attendance was created to determine if there was an interaction with parental involvement. All of these variables were time-invariant, meaning that their values remained the same at each time point.

*Family SES.* Socioeconomic status of the family was evaluated with two variables: mother's highest level of education and an index of income (whether the student's family lives in poverty). Mother's highest level of education was centered around its mean prior to entry into the model.



*Gender.* An overview of the SEELS data from Wave I reported that girls performed more poorly on the mathematics calculations test (Blackorby, Chorost, Garza, & Guzman, 2004); therefore gender was included in the analyses.

*Initial grade level.* The grade the student was in at Wave 1 was included in the model as a control variable. Controlling for initial grade was necessary as there was a wide range of grades for the students in the sample (i.e., grade 1 to 9) and achievement is closely related to grade level. This variable was centered around its mean before entering it into the model. This variable was used to create a dichotomous variable that indicated whether the student was in elementary school (grades 1 to 5) at the start of the study. This elementary school indicator was used to test for an interaction with parental involvement, as previous research indicated that the effects of parental involvement can differ based on grade level.

*VI as primary disability.* All students with a visual impairment reported were included in the sample, including those for whom VI was not the primary disability. Because these groups of students were thought to potentially be different in terms of mathematics achievement, a dichotomous variable was created to identify those for whom VI was the primary disability.

*Cognitive disability.* Students with cognitive disabilities were expected to have lower mathematics achievement; therefore presence of a cognitive disability was included as a control variable in our analyses. A dichotomous cognitive disability variable was created based on data from several variables present in the database, including (a) primary disability identified for the student and (b) teacher report of disabilities the student has or (c) parent report of disabilities the student has if the teacher report was missing. Students in our sample were identified with a cognitive disability if they had mental retardation, autism, traumatic brain injury, or multiple disabilities.

*Statistical Technique*

The statistical technique used to analyze the data and test the hypotheses was multilevel modeling. Two primary advantages to this method are that it allows for an estimation of individual change trajectories as a function of person-specific parameters and random error, and it allows for the number and timing of observations to vary randomly across participants (Raudenbush & Bryk, 2002). In other words, with multilevel modeling the researcher can determine the average rate of change and individual variability in change over time, and can utilize all observations in the estimation of parameters, even if they include only one time point.

The statistical models have two levels: (a) the level-1 model, referred to as the individual growth model, which represents the change in the outcome measure experienced by each respondent over time and (b) the level-2 model which represents differences in changes in the outcome measure across respondents. SAS version 9.2 (SAS Institute, Inc., Cary, NC), and specifically the PROC MIXED procedure with full maximum likelihood estimation, was used for the analyses. Prior to initiating hypothesis testing, the SEELS dataset was converted from its current person-level format to a person-period format.

Two separate models were fit, one for each independent variable. The model-fitting method recommended by Singer and Willett (2003) was followed. The unconditional growth model, which includes time as its only predictor, was examined first. Time was modeled as both a fixed and a random effect in both models, but its random effect was nonsignificant and was removed from the models. The independent variable and its interaction with time was entered into each model next, followed by the control variables. Interactions between parental involvement and elementary school attendance and cognitive disability were entered into the

models next. Variables that were not significant at the  $p = .05$  level were removed to obtain the final models.

## Results

### *Demographics of Sample*

The total sample of 425 was used to report these demographic characteristics. The majority of the sample was male (60%). Race/ethnicity breakdowns were as follows: White (57.9%), African American (23.5%), Hispanic (14.6%), Asian/Pacific Islander (3.1%), and the remaining 1% were of another race or multi-race. The majority of students (64.2%) were in elementary school at the beginning of the study (grades 1-5), and the remainder were in middle school (grades 6-8; 36.3%) or 9<sup>th</sup> grade (0.5%). The primary disability for 80.2% of the students was visual impairment and 14.6% had a cognitive disability in addition to their visual impairment. Almost 15% of the students' parents reported that their child was totally blind. Mother's level of education varied from less than high school (13.7%) to high school (32%), to some college (29.7%), to a bachelor's degree or higher (24.7%). Approximately 24% of the students' families lived in poverty.

### *Levels of Parental Involvement*

Levels of parental involvement at home (PIH) were high for most students. The average level of PIH across all time points was 9.48 (SD=1.80), and the full range of 3 to 12 was reported. This level did vary by wave, with greater levels of PIH reported in the earlier waves, when students were younger. Means and standard deviations at each wave were: 10.17 (1.64), 9.44 (1.76), and 8.82 (1.75).

Levels of parental involvement at school (PIS) were low for most students, but there was a significant amount of variability. The average level of PIS across all time points was 4.13

(SD=3.01), and the full range of 0 to 12 was reported. As with PIH, level of PIS varied by Wave, with successively lower levels reported at each wave. Means and standard deviations at each wave were: 4.56 (3.09), 4.05 (3.04), and 3.81 (2.85).

Although average levels of each variable were different (one at the high end of its scale and one at the low end of its scale), there was a correlation of .27 ( $p < .01$ ) between the variables. This significant correlation indicates that the two parental involvement scores tended to vary together, but the relationship was only moderate in size. Therefore, some parents who reported a high level of involvement at home reported limited, or no, involvement at school, while some who reported a below-average level of involvement at home reported a high level of involvement at school.

#### *Parental Involvement at Home*

Parental involvement was entered into the model first, followed by the control variables and interaction terms. Gender was the only control variable that was not significant and it was therefore dropped from both final models (see Table 1 for full results). Parental involvement at home significantly predicted mathematics achievement. However, the direction of the relationship differed by the presence of a cognitive disability. The relationship was negative for students without a cognitive disability and positive for students with a cognitive disability. The effect did not differ based on grade attended at Wave 1. The results of the model are displayed graphically in Figure 1 for illustration purposes. Three levels of PIH (low, average, and high) are displayed. The interaction between cognitive disability and parental involvement is demonstrated by the reversal of the effect of the low-to-high levels of PIH. Note that all graphs assume the same level of parental involvement at each time point, although this variable was time invariant and could change over time.

*Parental Involvement at School*

Parental involvement at school (PIS) had a positive effect on mathematics achievement over time, but only for those students who were attending elementary school during Wave 1 (see Table 1 for full results). As was the case with PIH, the effect of PIS differed based on the presence of a cognitive disability. PIS had a negative relationship with mathematics achievement for students with a cognitive disability. This effect existed for all students, regardless of initial grade level. For students with a cognitive disability who were attending elementary school at Wave 1, this negative effect diminished over the course of the study due to the positive relationship of PIS over time. There was no effect of PIS on mathematics achievement for those students in the sample who were in middle school at Wave 1 and did not have a cognitive disability. The results of the model are presented graphically in Figure 2 (students in elementary school) and Figure 3 (students not in elementary school) for illustration purposes. Three levels of PIS (low, average, and high) are displayed.

## Discussion

The effect of both types of parental involvement differed based on the presence of a cognitive disability. For students without a cognitive impairment, the findings were similar to what has been documented for the general population of students: a negative relationship between PIH and achievement and a positive relationship between PIS and achievement, but only for students in elementary school at the beginning of the study. The relationship between PIS and achievement occurred over time, meaning that at the first time point there was no difference between groups, but the effect appeared and then increased over time. For students with cognitive disabilities, the relationships were different. A positive relationship between PIH and achievement was found and a negative relationship between PIS and achievement was

found. Results for each type of parental involvement and student population (cognitive disability or not) will be discussed separately.

### *Parental Involvement at Home*

A negative relationship between PIH and achievement has been found in some studies of the general population, particularly those focusing on homework help (Patall et al., 2008; Pomerantz et al., 2007). Suggestions for why this negative relationship would be exhibited have been presented. One suggestion is an achievement-to-involvement link: those students who are doing poorly receive more help and attention at home as a reaction to their low achievement. The negative relationship in this study may represent an association between those students who are doing poorly academically and greater amounts of parental help at home as a reaction to this. For the population in this study, the availability of accessible materials may also be an issue. Unfortunately, students who require Braille or large print textbooks and other school materials often do not receive them (American Foundation for the Blind, n.d.; Corn & Wall, 2002; DeMario & Lian, 2000). If the student with a visual impairment cannot access his or her homework or mathematics book independently, parents will be required to assist with homework. Those students without accessible materials could be expected to both perform more poorly and to require a significant amount of parental involvement at home, resulting in the negative association exhibited in this study.

It is also possible that lack of accessible materials and the amount of help required may cause parents to become frustrated, resulting in interactions marked by negative affect. Parental involvement characterized by negative affect is thought to result in negative outcomes for the child (Pomerantz et al., 2007). It is also possible that, even if the student does have accessible materials, he or she is not doing well in school and the parents do not understand why. Rather

than recognizing the difficulty the child is facing caused by the visual impairment, the parent may think the poor performance is associated solely with lack of effort or motivation. It is also likely that the child who either does not have accessible materials or who is not doing well in math is frustrated by the situation. This frustration may have an effect on the parent during their interactions about and with homework (Pomerantz et al., 2007). Either of these scenarios could result in the interactions between the parent and child being characterized by negative affect. Finally, it is possible that assisting children with mathematics homework is more difficult for most parents than providing assistance in other areas (Patall et al., 2008).

There are several plausible reasons that PIH and achievement would be negatively related for this population. Why then was there a positive relationship between these variables for students with cognitive impairments? Perhaps it is because students with both a VI and a cognitive disability are more likely to *require* some assistance and encouragement at home to succeed academically, regardless of accessibility of materials. Therefore, if all of these students generally need parental assistance, those who do not get as much will do worse, which is what was found. For students with two (and possibly more) significant disabilities including one that affects cognition, parents will likely expect that there is a need to be involved in their schoolwork at home and also may have realistic expectations as to their performance. This may result in a more pleasant experience, characterized by positive affect, for both the student and the parent when parents provide assistance and encouragement at home.

#### *Parental Involvement at School*

As documented in research with the general population, a positive relationship between PIS and mathematics achievement was found, but only for students who started the study in grades 1 through 5. This relationship was significant over time, meaning that PIS has a positive

effect on the growth of math achievement over time, for children who started the study in elementary school. Because this effect involved an interaction with time, the effect was strongest at the last wave, when many of these students were in middle school. PIS did not have an effect on achievement for students without a cognitive disability who started the study in middle school and progressed to high school during the study. These findings indicate that PIS is important for students with VI while in late elementary and middle school, but not in high school. These results differ slightly from previous research in which PIS had a positive, but weaker, relationship with achievement for students in middle school than in elementary school (Hill & Tyson, 2009). In our study the largest effect of PIS was seen in Wave 3, when students were in grades 4 to 8.

PIS has been theorized to effect achievement by increasing motivation for school in students (Pomerantz, et al., 2007). This may be one of the reasons for the positive relationship exhibited here. For this population, there may be an alternative explanation also. Students with VI are usually mainstreamed – unless they have significant additional disabilities – and are expected to keep up with the other students in their classes. This is possible *if* they are given the accommodations and supports they need. High levels of continued parental involvement at school may help students with VI get the appropriate accommodations and supports they need to function better and therefore perform better academically (Kelly, 2009). In some schools, it is possible that students will not receive the accommodations and supports they need without the advocacy of a parent. Perhaps it is for these students that PIS is most important, but this is not something we can assess with the available data. That the effect was seen in growth over time, not in initial scores, may be associated with the fact that at higher grades with increasing math complexity, the problems become more difficult to solve without accessible materials.



For students with cognitive disabilities, higher levels of parental involvement at school were associated with lower math achievement. It is possible that this relationship is a result of parents of students with VI and cognitive impairment who are doing poorly in school being more involved at the school. In other words, the poor achievement may result in greater school involvement, rather than PIS influencing achievement (the achievement-to-involvement link again). Why this only occurs for those students with cognitive impairments is unclear. One hypothesis is that with two significant disabilities – one which is expected to directly affect achievement – parents who see their child doing poorly are motivated to become involved at the school, perhaps with the belief that the more involved they are, the more they can help their child. This may be true for students in elementary school at Wave 1, as the negative effect of PIS decreases substantially over time for this group. In fact, differences at Wave 3 based on parental involvement were very small, although at Wave 1 they were of a moderate size. This occurred because of the faster growth in achievement associated with parental involvement for all students. Therefore, those who started out with high levels of parental involvement had lower achievement scores, but their growth in achievement over time was greater, if parental involvement remained at the same level (see Figure 2). However, for students with cognitive disabilities in middle school at Wave 1, the negative effect persisted over time.

### *Implications and Recommendations*

One key finding from this study was the positive effect of PIS on mathematics achievement that occurred over time for students who started the study in elementary school. This effect was greatest at the last time point of the study – when students were in grades 4 to 8. Levels of parental involvement are generally highest in the earlier grades, and as children age, parental involvement tends to decrease. This pattern was exhibited in the study also. The results

of this study support the importance of continued high levels of involvement at school as students with VI get older.

Another pattern exhibited in this study that occurs in the general population was the high level of PIH but relatively low levels of PIS. This study confirmed the importance of PIS for youth with VI (at least those who were in elementary school at the beginning of the study), but levels of PIS tended to be low. An implication of this finding is for teachers and administrators to encourage more parental involvement at the school for parents of youth with VI. With the No Child Left Behind legislation, increasing parental involvement is a goal of the educational system. The importance of encouraging parental involvement has been recognized by the government, but each school district, individual school, and teacher must also do their part in encouraging parental involvement.

Research supports the potential benefits of policies and programs aimed at increasing parental involvement (Hill & Taylor, 2004). Schools should ensure that they offer a number of opportunities for organized parental involvement and should increase their advertisement of these opportunities. Some parents may not know about their chances for involvement at the school and providing this information to them could increase their participation. Other parents may be aware of the opportunities but not feel that they would “fit in” at the school or that they do not have anything to offer (Long, 2007). Techniques to encourage participation from parents such as these should be employed. The timing of the opportunities for involvement should be considered too: most parents who work full-time cannot be involved during regular work hours, but could possibly come in early in the morning or at their lunch hour. Providing flexible options for involvement is important to allow more parents to participate.

Teachers can also be an important party in increasing parental involvement, both in school and at home, but teachers may not have the resources or knowledge of how to promote parental involvement (Hill & Taylor, 2004). Ideally, every student with a VI will have a teacher for the visually impaired. Training programs for these teachers could include a component on how to encourage involvement and how to effectively involve parents. Research supports the idea that parents want and will respond to information about assisting their children (e.g., Hill & Taylor, 2004; LaParo, Kraft-Sayre, & Pianta, 2003; Minner, 1989). Including material about effectively involving parents in training curriculums for teachers for the VI could help increase the interaction between teachers and parents and increase parental involvement.

A negative relationship was found between PIH and mathematics achievement for youth without a cognitive disability, which has been found in previous correlational research involving the general population of students (e.g., Patall et al., 2008). This does not mean that an intervention aimed at increasing PIH would not be beneficial for this population. In fact, two reviews have found that experimental studies documented a positive relationship between parental involvement in homework and math achievement for the general population of students (Nye et al., 2006; Patall et al., 2008). An intervention focused on increasing involvement of parents of students in special education also documented a positive effect on improved math performance (Minner, 1989). These findings, combined with the finding of a negative relationship between mathematics achievement and naturally occurring PIH, indicate that an intervention in this area is needed.

Mathematics is a subject area that many parents may not be comfortable helping their children with, due to lack of mathematics skills themselves or unfamiliarity with current instructional strategies (Patall et al., 2008). Parents of students with VI may not feel comfortable

helping their children with their mathematics homework for additional reasons. If the student requires Braille (and therefore Nemeth code) and has this accommodation for homework, the parent may find it difficult to work with the child because he or she does not understand Nemeth code. If, on the other hand, the child needs accommodations and does not receive them, the parent also may find it difficult to help them. How would the parent suggest the child complete his or her homework without the appropriate materials to use? What hints or advice could the parent provide to help students who may have to primarily rely on hearing and memory to solve math problems? Without some assistance from a teacher for the VI, parents likely will not be able to effectively help their children who require accommodations for their vision loss. Therefore, interventions to support parents in helping their VI children with mathematics homework may be very beneficial.

### *Limitations*

Limitations of this study should be mentioned. Although the longitudinal nature of the study is a strength, the data are from naturally occurring situations and are thus essentially correlational. As has been suggested, it is possible that other factors (e.g., cognitive disability) may impact both parental involvement and achievement. Thus, our inferences as to the “effects” of parental involvement must be approached with caution and with attention to findings from previous research.

### *Conclusions*

This is the first published research on the relationship between parental involvement and achievement of youth with visual impairments. A significant relationship between both parental involvement at home and parental involvement at school was documented in this study. An interesting finding was the differential effect of parental involvement based on the presence of a

cognitive disability. Perhaps results for those students with combined vision and cognitive disabilities were more consistent with results for all students with a cognitive disability. Because no research on this population is available, we cannot confirm or deny this. However, additional research is necessary to support the findings presented here.

For students without a cognitive disability, parental involvement at home had a negative relationship with achievement. The authors are not aware of any interventions that have focused on increasing parental involvement and its impact on mathematics achievement for students with visual impairments, but these results indicate that parents may need assistance with how to provide help to their children at home. Such an intervention could involve both components of interventions successful in improving mathematics achievement for the general population, such as interactive homework assignments (Sheldon & Epstein, 2005), and components specific to teaching parents about mathematics instruction for students with visual impairments.

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Table 1

*Results of Model Building: Parameter Estimates of Fixed Effects*

Variable	Parental Involvement at Home	Parental Involvement at School
Intercept	494.48 (2.65)	490.71 (2.87)
Time	4.96 (0.47)	7.94 (1.01)
Parental Involvement (PI)	-1.35 (0.47)	--
PI x Time x Elementary	--	0.46 (0.14)
Initial grade	7.19 (0.61)	7.54 (0.58)
Initial grade x Time	-1.02 (0.24)	-0.98 (0.21)
VI as primary	9.88 (2.58)	12.84 (2.93)
VI as primary x Time	--	-2.24 (1.06)
Cognitive disability	-18.47 (3.07)	-14.33 (3.36)
Cognitive disability x Time	--	-3.59 (1.21)
Mother's education level	2.09 (0.52)	1.82 (0.52)
Living in poverty	-7.20 (2.34)	-8.13 (2.34)
PI x Cognitive disability	2.39 (1.10)	-1.55 (0.65)

All variables retained in the models are significant at  $p < .05$ .

Figure 1

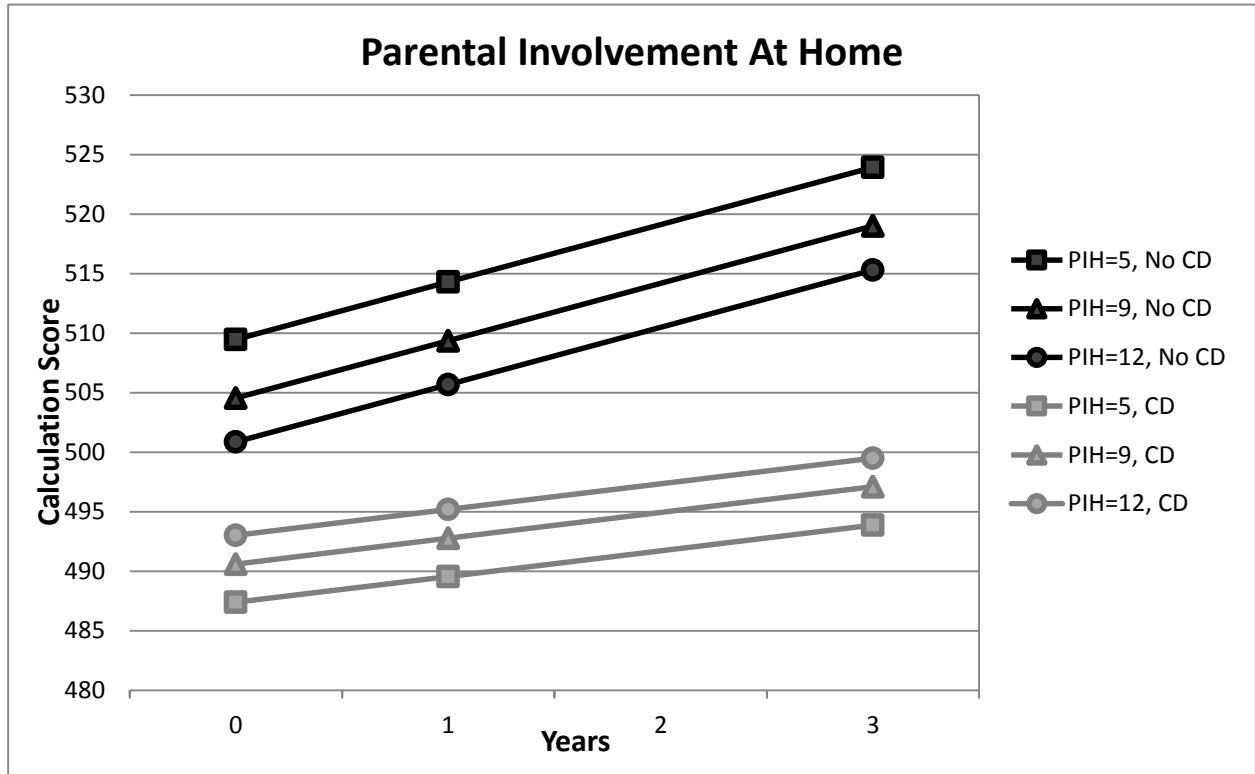


Figure 2

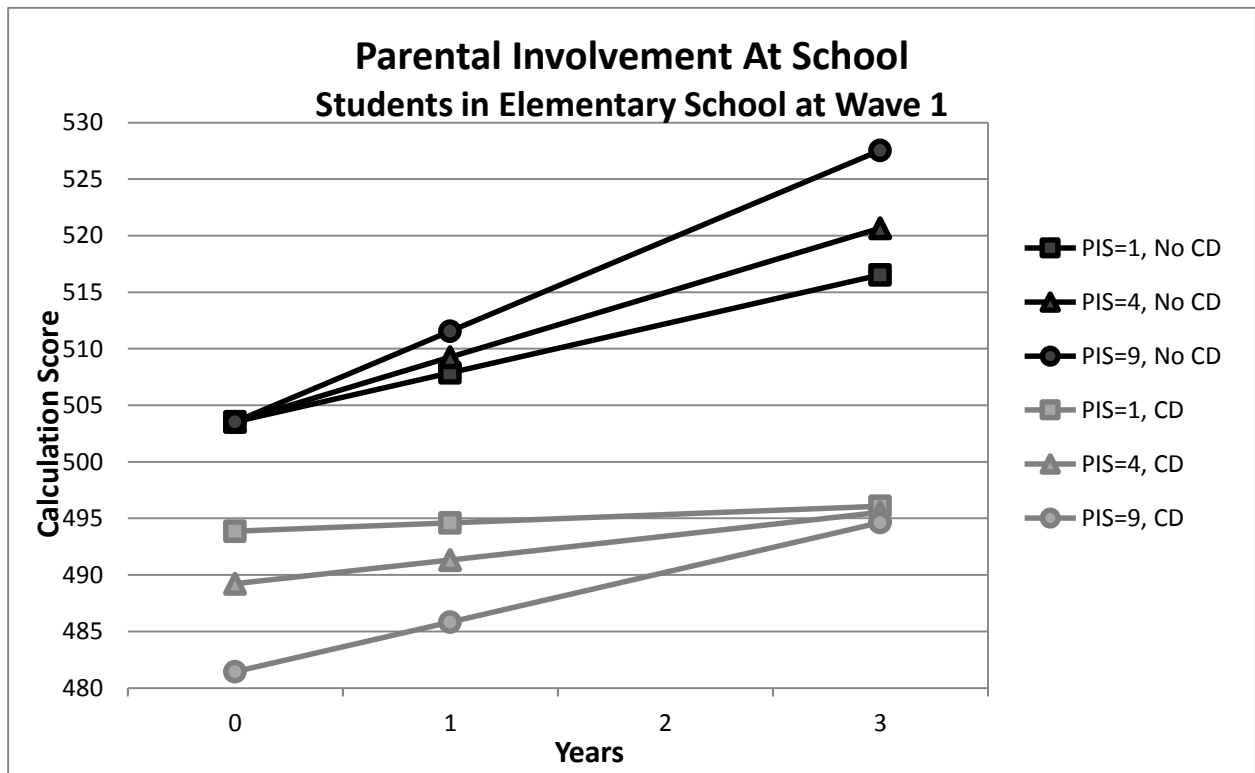


Figure 3

